**Final Sample Problems**

**Problem 1**

For the information system given below, find the set of all coverings of C and rules describing C in terms of E, F, G. Use RSES method.

Assume that Dom(E) = {e1, e2}, Dom(F) = {f1, f2}, Dom(C) = {c1, c2}.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| X | **E** | **F** | G | C |
| x1 | **e2** | **f1** | g3 | c2 |
| x2 | **e1** | **f2** | g3 | c1 |
| x3 | **e1** | **f2** | g2 | c1 |
| x4 | **e1** | **f1** | g3 | c2 |
| x5 | **e2** | **f2** | g1 | c2 |
| x6 | **e2** | **f1** | g1 | c2 |

**Problem 2.**

Find the set of representative rules RR(3,75%) for the set of transactions: (A,C,D,F,I), (B,C,D,H,E,I), (A,B,C,E,H), (A,C,D,E,H), (B,D,E,H,I) following Agrawal algorithm.

**Solution.**

A-3, B-3, C-4, D-4, E-4, F-1, H-4, I-3

AB-1 AC-3 AD-2 AE-2 AH-2 AI-1 BC-2 BD-2 BE-3 BH-3 BI-2

CD-3 CE-3 CH-3 CI-2 DE-3 DH-3 DI-3 EH-4 EI-2 HI-2

BEH-3 CDE-2 CDH-2 CEH-3 DEH-3 ~~DEI~~ ~~DHI~~

DEH

D-> EH conf=3/4, E->DH conf=3/4, H->DE conf=3/4

CEH

C->EH H->DE E->HD

**Problem 3.**

Discretize attributes A and B in the Decision Table below. {A, B} are classification attributes. D is the decision attribute.

|  |  |  |  |
| --- | --- | --- | --- |
| X | a | b | d |
| x1 | 1 | 3 | 1 |
| x2 | 5 | 5 | 2 |
| x3 | 5 | 3 | 2 |
| x4 | 3 | 8 | 1 |
| x5 | 8 | 5 | 1 |
| x6 | 8 | 1 | 2 |

**Solution:**

A: 1 3 5 8 B: 1 3 5 8

p1 p2 p3 q1 q2 q3

F(1,2)= p1 + p2 + q2

F(1,3)= p1 + p2

F(1,6)= p1 + p2 + p3 + q1

F(2,4)= p2 + q3

F(2,5)= p3

F(3,4)= p2 + q2 + q3

F(3,5)= p3 + q2

F(4,6)= p2 + p3 + q1 + q2+ q3

F(5,6)= q1 + q2

p1- 2, p2-4, q2- 3, q3-2, q1-1

Minimal sets of cuts: {p2, p3, q1}, {p2,p3, q2}

Let’s take {p2, p3, q1}

A: 1 3 5 8 B: 1 3 5 8

p1 p2 p3 q1 q2 q3

A: (-, 4], (4,6], (6,-) B: (-, 2], (2,-)

|  |  |  |  |
| --- | --- | --- | --- |
| X | a | b | d |
| x1 | (-, 4] | (2,-) | 1 |
| x2 | (4,6] | (2,-) | 2 |
| x3 | 5 | (2,-) | 2 |
| x4 | 3 | (2,-) | 1 |
| x5 | 8 | (2,-) | 1 |
| x6 | 8 | (-,2] | 2 |

**Problem 4.**

Find classification rules in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Car | Price | Mileage | Size | Accident | d |
| 1 | \* | {mid} | {full} | \* | good |
| 2 | {low} | \* | {full} | {engine} | good |
| 3 | \* | {high} | {compact} | \* | poor |
| 4 | {high} | {low} | \* | {doors} | good |
| 5 | \* | \* | {full} | {doors} | excel |
| 6 | {low} | {high} | {compact} | \* | poor |

Solution:

T(1)={1,2, 5}

T(2)={2,1}

T(3)={3, 6}

T(4)={4,5}

T(5)={5,1, 4}

T(6)={6,3}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Car | Price | Mileage | Size | Accident | D |
| 1 | \* | {mid} | {full} | \* | good+excel |
| 2 | {low} | \* | {full} | {engine} | good |
| 3 | \* | {high} | {compact} | \* | poor |
| 4 | {high} | {low} | \* | {doors} | good+excel |
| 5 | \* | \* | {full} | {doors} | good+excel |
| 6 | {low} | {high} | {compact} | \* | poor |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | x |  |  |  |  |  |
| 2 | NIL | x |  |  |  |  |
| 3 | M, S | S | x |  |  |  |
| 4 | - | P, A | M | x |  |  |
| 5 | - | A | S | - | x |  |
| 6 | M, S | S | - | P, M | S | x |

F(3)=(M+S)SM F(4)=(P+A)M(P+M) F(5)=AS F(6)=(M+S)S(P+M)

F(3)=SM F(4)=(P+A)M=PM+AM F(5)=AS F(6)=S(P+M)=SP+SM

Rules: (M,high)\*(S,compact) => (D, poor)

(P,high)\*(M.low) => (D, good+excel)

(A, doors)\*(M,low) => (D,good + excel)

(A,doors)\*(S,full) => (D,good+ excel)

**Problem 5**

Assume that two-dimensional space MxN contains 8 objects listed in Table 1. Apply k-means (k=2) algorithm to cluster Y.

|  |  |  |
| --- | --- | --- |
| Y | M | N |
| y1 | 1 | 2 |
| y2 | 2 | 4 |
| y3 | 6 | 2 |
| y4 | 1 | 8 |
| y5 | 6 | 6 |
| y6 | 1 | 4 |
| y7 | 4 | 2 |
| y8 | 5 | 3 |

Table 1

**Solution**

Let’s take K=2 and assume that Y3, Y6 are the seeds.

We need to build clusters C(Y3), C(Y6).

Take Y1, d(Y1,Y3)=5, d(Y1,Y6)=2.

So, C(Y3)={Y3}, C(Y6)={Y6,Y1}

Take Y2, d(Y2,Y3)=6, d(Y2,Y6)=1.

So, C(Y3)={Y3}, C(Y6)={Y6,Y1,Y2}

Take Y4, d(Y4,Y3)=11, d(Y4,Y6)=4.

So, C(Y3)={Y3}, C(Y6)={Y6,Y1,Y2,Y4}

Take Y5, d(Y5,Y3)=4, d(Y5,Y6)=7.

So, C(Y3)={Y3,Y5}, C(Y6)={Y6,Y1,Y2,Y4}

Take Y7, d(Y7,Y3)=2, d(Y7,Y6)=5.

So, C(Y3)={Y3,Y5,Y7}, C(Y6)={Y6,Y1,Y2,Y4}

Take Y8, d(Y8,Y3)=2, d(Y8,Y6)=5.

So, C(Y3)={Y3,Y5,Y7,Y8}, C(Y6)={Y6,Y1,Y2,Y4}

Now we have to find center for C(Y3) and C(Y6)

C(Y3)

|  |  |  |
| --- | --- | --- |
| Y | M | N |
| y3 | 6 | 2 |
| y5 | 6 | 6 |
| y7 | 4 | 2 |
| y8 | 5 | 3 |

21/4 13/4 -> Seed1 = (5.25, 3.25)

C(Y6)

|  |  |  |
| --- | --- | --- |
| Y | M | N |
| y1 | 1 | 2 |
| y2 | 2 | 4 |
| y4 | 1 | 8 |
| y6 | 1 | 4 |

5/4 18/4 -> Seed2= (1.25, 4.5)

Now, we need to build clusters around these two seeds.

**Problem 6**

Assume that two-dimensional space MxN contains 8 objects listed in Table 1 (see Problem 1). Apply agglomerative strategy (bottom-up) to cluster objects in Y. Use Manhattan distance

/ d(yi, yj) = |Mi – Mj | + |Ni – Nj | / for objects yi, yjin Yand the distance d(R,Q)= 1/2**⋅**d(A,Q) + 1/2**⋅**d(B,Q) - 1/2**⋅**d(A,B) between clusters R and Q, if R is formed by merging clusters A and B in Y.

Distance matrix for objects in Y

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 | Y8 |
| Y1 | x |  |  |  |  |  |  |  |
| Y2 | 3 | x |  |  |  |  |  |  |
| Y3 | 5 | 6 | x |  |  |  |  |  |
| Y4 | 6 | 5 | 11 | x |  |  |  |  |
| Y5 | 11 | 6 | 4 | 7 | x |  |  |  |
| Y6 | 2 | 1 | 7 | 4 | 7 | x |  |  |
| Y7 | 3 | 4 | 2 | 9 | 6 | 5 | x |  |
| Y8 | 5 | 4 | 2 | 9 | 4 | 5 | 2 | x |

**Solution**

d(yi, yj) = |Mi – Mj | + |Ni – Nj | for objects yi, yjin Y

d(R,Q)= 1/2**⋅**d(A,Q) + 1/2**⋅**d(B,Q) - 1/2**⋅**d(A,B) where cluster R is formed by merging clusters A and B.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 | Y8 |
| Y1 | x |  |  |  |  |  |  |  |
| Y2 | 3 | x |  |  |  |  |  |  |
| Y3 | 5 | 6 | x |  |  |  |  |  |
| Y4 | 6 | 5 | 11 | x |  |  |  |  |
| Y5 | 11 | 6 | 4 | 7 | x |  |  |  |
| Y6 | 2 | 1 | 7 | 4 | 7 | x |  |  |
| Y7 | 3 | 4 | 2 | 9 | 6 | 5 | x |  |
| Y8 | 5 | 4 | 2 | 9 | 4 | 5 | 2 | x |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | {Y1} | {Y2, Y6} | {Y3} | {Y4} | {Y5} | {Y7} | {Y8} |
| {Y1} | x |  |  |  |  |  |  |
| {Y2, Y6} | 3 | x |  |  |  |  |  |
| {Y3} | 5 | ? | x |  |  |  |  |
| {Y4} | 6 | ? | 11 | x |  |  |  |
| {Y5} | 11 | ? | 4 | 7 | x |  |  |
| {Y7} | 3 | ? | 2 | 9 | 6 | x |  |
| {Y8} | 5 | ? | 2 | 9 | 4 | 2 | x |

d(R,Q)= 1/2**⋅**d(A,Q) + 1/2**⋅**d(B,Q) - 1/2**⋅**d(A,B), where R = A∪B

d({Y2,Y6},{Y3})= 1/2⋅d(Y2,Y3)+1/2⋅d(Y6,Y3)-1/2⋅d({Y2},{Y6})=

(1/2)⋅6 + (1/2)⋅7 – (1/2)⋅1 = 3+3 = 6

d({Y2,Y6},{Y4})= 1/2⋅d(Y2,Y4)+1/2⋅d(Y6,Y4)-1/2⋅d({Y2},{Y6})=

(1/2)⋅5 + (1/2)⋅4 – (1/2)⋅1 = 2+2 = 4

d({Y2,Y6},{Y5})= 1/2⋅d(Y2,Y5)+1/2⋅d(Y6,Y5)-1/2⋅d({Y2},{Y6})=

(1/2)⋅6 + (1/2)⋅7 – (1/2)⋅1 = 3 + 3 = 6

d({Y2,Y6},{Y7})= 1/2⋅d(Y2,Y7)+1/2⋅d(Y6,Y7)-1/2⋅d({Y2},{Y6})=

(1/2)⋅4 + (1/2)⋅5 – (1/2)⋅1 = 2 + 2 = 4

d({Y2,Y6},{Y8})= 1/2⋅d(Y2,Y8)+1/2⋅d(Y6,Y8)-1/2⋅d({Y2},{Y6})=

(1/2)⋅4 + (1/2)⋅5 – (1/2)⋅1 = 2 + 2 = 4

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | {Y1} | {Y2, Y6} | {Y3} | {Y4} | {Y5} | {Y7} | {Y8} |
| {Y1} | x |  |  |  |  |  |  |
| {Y2, Y6} | 3 | x |  |  |  |  |  |
| {Y3} | 5 | 6 | x |  |  |  |  |
| {Y4} | 6 | 4 | 11 | x |  |  |  |
| {Y5} | 11 | 6 | 4 | 7 | x |  |  |
| {Y7} | 3 | 4 | 2 | 9 | 6 | x |  |
| {Y8} | 5 | 4 | 2 | 9 | 4 | 2 | x |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | {Y1} | {Y2, Y6} | {Y3, Y7} | {Y4} | {Y5} | {Y8} |
| {Y1} | x |  |  |  |  |  |
| {Y2, Y6} | 3 | x |  |  |  |  |
| {Y3, Y7} | ? | ? | x |  |  |  |
| {Y4} | 6 | 4 | ? | x |  |  |
| {Y5} | 11 | 6 | ? | 7 | x |  |
| {Y8} | 5 | 4 | ? | 9 | 4 | x |

d(R,Q)= 1/2**⋅**d(A,Q) + 1/2**⋅**d(B,Q) - 1/2**⋅**d(A,B), where R = A∪B

d({Y1},{Y3,Y7}) = 1/2⋅d({Y1},{Y3}) + 1/2⋅d({Y1},{Y7}) – 1/2⋅d({Y3,Y7}) =

= (1/2)⋅5 + (1/2)⋅3 – (1/2)⋅2 = 4 – 1 = 3

d({Y2,Y6},{Y3,Y7}) =

1/2⋅d({Y2,Y6},{Y3}) + 1/2⋅d({Y2,Y6},{Y7}) – 1/2⋅d({Y3,Y7}) =

(1/2)⋅6 + (1/2)⋅4 – (1/2)⋅2 = 5 – 1 = 4

d({Y4},{Y3,Y7}) = 1/2⋅d({Y4},{Y3}) + 1/2⋅d({Y4},{Y7}) – 1/2⋅d({Y3,Y7}) =

(1/2)⋅11 + (1/2)⋅9 - (1/2)⋅2 = 10 – 1 = 9

d({Y5},{Y3,Y7})=1/2d(Y5,Y3) + 1/2d(Y5,Y7) – 1/2d(Y3,Y7)= ½\*4+(1/2)\*6-(1/2)\*2= 2+3+1 = 6

d(Y8,{Y3,Y7})= ½\*d(Y8, Y3) + 1/2d(Y8,Y7)-1.2d(Y3,Y7)= ½ \*2+(1/2)\*2 -(1/2)\*2 = 1 + 1 – 1 = 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | {Y1} | {Y2, Y6} | {Y3, Y7} | {Y4} | {Y5} | {Y8} |
| {Y1} | x |  |  |  |  |  |
| {Y2, Y6} | 3 | x |  |  |  |  |
| {Y3, Y7} | 3 | 4 | x |  |  |  |
| {Y4} | 6 | 4 | 9 | x |  |  |
| {Y5} | 11 | 6 | 4 | 7 | x |  |
| {Y8} | 5 | 4 | 1 | 9 | 4 | x |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | {Y1} | {Y2, Y6} | {Y3, Y7, Y8} | {Y4} | {Y5} |
| {Y1} | x |  |  |  |  |
| {Y2, Y6} | 3 | x |  |  |  |
| {Y3, Y7, Y8} | 3 | 3.5 | x |  |  |
| {Y4} | 6 | 4 | ? | x |  |
| {Y5} | 11 | 6 | ? | 7 | x |

d(Y1, {{Y3, Y7},Y8})= ½\*d(Y1, {Y3, Y7}) + ½ \* d(Y1, Y8) – ½\*d{{Y3,Y7},Y8)=

½ \* 3 + ½ \* 5 – ½ \* 1 = 1.5 + 2.5 -1 = 3

d({{Y3, Y7},Y8}, {Y2,Y6}) = ½ \* d({Y3, Y7}, {Y2,Y6}) + ½ \* d(Y8, {Y2,Y6})- ½ \*d(({Y3,Y7}, Y8) = ½ \* 4 + ½ \* 4 – ½ \* 1 = 2 +2 – ½ = 3.5

**Problem 7.** Follow DEAR1 algorithm to extract action rules reclassifying objects from the class D0 to the class D1 hidden in table T. Attributes A, C are stable.

A B C D

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| X1 | 2 | 2 | 1 | 0 |
| X2 | 1 | 1 | 1 | 1 |
| X3 | 2 | 1 | 2 | 1 |
| X4 | 1 | 3 | 1 | 0 |
| X5 | 1 | 3 | 2 | 1 |
| X6 | 1 | 1 | 2 | 0 |

Table T.

**Solution.**

d0\*={x1,x4,x6}, d1\*={x2,x3,x5}

a1\*={x2,x4,x5,x6}, a2\*={x1,x3}

b1\*={x2,x3,x6}, b2\*={x1}<d0\*, b3\*={x4,x5}

c1\*={x1,x2,x4}, c2\*={x3,x5,x6}

a1.b1\*= {x2,x6} ~~a1.b3\*=b3\*~~, a1.c1\*={x2,x4} a1.c2\*= {x5,x6}

a2.b1\*={x3}<d1\* ~~a2.b3\*=~~  a2.c1\*= {x1}<d0\* a2.c2\*= {x3}<d1\*

b1.c1\*={x2}<d1\* b1.c2\*={x3,x6} b3.c1\*={x4}<d0\* b3.c2\*={x5}<d1\*

a1.b1.c1\*={x2} <d1\*, a1.b1.c2\*={x6}<d0\*

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | C | D |
|  | B2 |  | D0 |
| A2 | B1 |  | D1 |
| A2 |  | C1 | D0 |
| A2 |  | C2 | D1 |
|  | B1 | C1 | D1 |
|  | B3 | C1 | D0 |
|  | B3 | C2 | D1 |
| A1 | B1 | C1 | D1 |
| A1 | B1 | C2 | D0 |

T - table

**Problem 8.** Let S=(X, {a, b, c, d}) be a decision system, where all attributes are flexible. Attribute d is the decision attribute. Find action rules reclassifying objects from the class d1 to d2 using action reducts.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | a | b | c | d |
| x1 | a3 | b1 | c3 | d1 |
| x2 | a3 | b2 | c1 | d2 |
| x3 | a1 | b1 | c1 | d2 |
| x4 | a2 | b1 | c1 | d1 |
| x5 | a1 | b1 | c3 | d1 |
| x6 | a2 | b2 | c2 | d2 |

System S

**Solution:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **X2** | **X3** | **X6** |
| **X1** | **b2, c1** | **a1, c1** | **a2, b2, c2** |
| **X4** | **a3, b2** | **a1** | **b2, c2** |
| **X5** | **a3, b2, c1** | **c1** | **a2, b2, c2** |

R(x2)= (b2+c1)(a3+b2)(a3+b2+c1) =

(b2+c1)(a3+b2)=b2.a3+b2+c1.a3+c1.b2 = b2+c1.a3

R(x3)=(a1+c1).a1.c1 = a1.c1 R(x6)= b2 + c2

{c1,a3}, {b2}, {a1,c1}, {c2} – Reducts

b1.(c, -> c1).(a, -> a3) => (d, d1 -> d2) Dom= {x1,x4,x5} b - can not be used

(c, -> c1).(a, -> a3) => (d, d1 -> d2) Dom= {x1,x4,x5} - does not change

a1.(b,b1 -> b2) => (d, d1->d2) Dom= {x5}

a2.(b, b1-> b2) => (d, d1->d2) Dom= {x4}

a3.(b,b1 -> b2) => (d, d1->d2) Dom= {x1}

c1.(b, b1-> b2) => (d, d1->d2) Dom= {x4}

c3.(b, b1-> b2) => (d, d1->d2) Dom= {x1,x5}

b1.(a, -> a1).(c, ->c1) => (d, d1 -> d2) Dom= {x1,x4,x5} b – can not be used

(a, -> a1).(c, ->c1) => (d, d1 -> d2) Dom= {x1,x4,x5} - does not change

a1.(c, c3->c2) => (d, d1->d2) Dom= {x5}

a2.(c, c1->c2) => (d, d1->d2) Dom={x4}

a3.(c, c3->c2) => (d, d1->d2) Dom={x1}

**Problem 9**: **A**ssume that {Table 1, Table 2} represents distributed information system where Table1 and Table 2 are semantically similar. Create new attribute g in Table 1 using knowledge extracted from Table 2.

a b c d f

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x1 | 1 | 1 | 2 | 1 | 1 |
| x2 | 3 | 1 | 2 | 2 | 0 |
| x3 | 1 | 2 | 2 | 1 | 2 |
| x4 | 2 | 1 | 1 | 2 | 1 |
| x5 | 3 | 1 | 2 | 2 | 0 |
| x6 | 3 | 2 | 1 | 2 | 1 |
| x7 | 2 | 2 | 1 | 2 | 2 |

Table 1.

a e c d g

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| y1 | 1 | 1 | 2 | 1 | 1 |
| y2 | 2 | 1 | 2 | 2 | 0 |
| y3 | 1 | 2 | 2 | 1 | 1 |
| y4 | 1 | 1 | 1 | 1 | 1 |
| y5 | 3 | 1 | 2 | 2 | 0 |
| y6 | 3 | 1 | 1 | 2 | 1 |
| y7 | 3 | 2 | 2 | 2 | 0 |

Table 2.

Solution: g0\*={y2,y5,y7}, g1\*={y1,y3,y4,y6}

a1\*={y1,y3,y4}<g1\*, a3\*={y5,y6,y7}, c2\*={y1,y2,y3,y5,y7}, c1\*={y4,y6}<g1\*, d1\*={y1,y3,y4}<g1\*, d2\*={y2,y5,y6,y7},

a3.c2\*={y5,y7}<g0\*, a3.d2\*=a3\*,

a1->g1, s=3, c=1; a3->g1, s=1, c=1/3; c2->g1, s=2, c=2/5;

c1->g1, s=2, c=1; d1->g1, s=3, c=1; d2->g1, s=1, c=1/4;

a2\*={y2} < g0\*, a3\*={y5,y6,y7} , c2\*={y1,y2,y3,y5,y7} , c1\*={y4,y6}

d2\*={y2,y5,y6,y7}, a3.c2\*={y5,y7}<g0\*, a3.d2\*=a3\*, c2.d2\*={y2,y5,y7}<g0\*,

Rules:

a2->g0 s=1, c=1; a3->g0 s=2, c=2/3; c2->g0, s=3, c=3/5; d2->g0, s=3 , c=3/4; a3.c2->g0, s=2, c=1; c2.d2->g0, s=3, c=1.

a1->g1, s=3, c=1; a3->g1, s=1, c=1/3; c2->g1, s=2, c=2/5;

c1->g1, s=2, c=1; d1->g1, s=3, c=1; d2->g1, s=1, c=1/4

a b c d f g

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| x1 | 1 | 1 | 2 | 1 | 1 | (g0, 3\* 3/5), (g1, 3\*1+2\*2/5+ 3\*1) |
| x2 | 3 | 1 | 2 | 2 | 0 | (g0, 2\*2/3+3\*3/5+3\*3/4+2+3), (g1,1/3+2\*2/5+1/4) |
| x3 | 1 | 2 | 2 | 1 | 2 | (g0, 3\*3/5), (g1 3\*1 +2\*2/5+3\*1) |
| x4 | 2 | 1 | 1 | 2 | 1 | (g0,1+3\*3/4), (g1,2+1\*1/4) |
| x5 | 3 | 1 | 2 | 2 | 0 | (g0,2\*2/3+3\*3/5+3\*3/4+2+3), (g1,2\*2/5+1\*1q/4) |
| x6 | 3 | 2 | 1 | 2 | 1 | (g0,2\*2/3+3\*3/4), (g1,1/3+2+1/4) |
| x7 | 2 | 2 | 1 | 2 | 2 | (g0,1+3\*3/4), (g1,2+1/4) |

Table 1.

a b c d f g

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| x1 | 1 | 1 | 2 | 1 | 1 | (g0,9/43), (g1,34/43) |
| x2 | 3 | 1 | 2 | 2 | 0 | (g0,2\*2/3+3\*3/5+3\*3/4+2+3), (g1,1/3+2\*2/5+1/4) |
| x3 | 1 | 2 | 2 | 1 | 2 | (g0,9/43), (g1,34/43) |
| x4 | 2 | 1 | 1 | 2 | 1 | (g0,1+3\*3/4), (g1,2+1\*1/4) |
| x5 | 3 | 1 | 2 | 2 | 0 | (g0,2\*2/3+3\*3/5+3\*3/4+2+3), (g1,2\*2/5+1\*1q/4) |
| x6 | 3 | 2 | 1 | 2 | 1 | (g0,2\*2/3+3\*3/4), (g1,1/3+2+1/4) |
| x7 | 2 | 2 | 1 | 2 | 2 | (g0,13/22), (g1,9/22) |

Table 1.